

Assessment Schedule – 2009

Statistics and Modelling: Use probability distribution models to solve straightforward problems (90646)

Evidence Statement

Question	Evidence	Code	Judgement	Sufficiency
One (a)	Normal ($\mu = 73.7$ kg $\sigma = 17.2$ kg) $P(X > 70) = P(Z > -0.215)$ $= 0.5851$ (tables) $= 0.58516$ (gc)	A	Accept CAO without any working.	1(a) correct for Achievement.
(b) (i)	Normal ($\mu = 20.4$ kg $\sigma = 2.1$ kg) $P(X > a) = 0.018$ $\Rightarrow Z = 2.096$ (accept 2.0965 or 2.097) $2.096 = \frac{a - 20.4}{2.1}$ $a = 24.8$ kg So minimum weight to be classified as <i>heavy</i> is 24.8 kg	M	Accept CAO without any working.	1(b)(i) correct for Merit
(ii)	$E[T] = 73.7 \times 10 + 20.4 \times 5 = 839$ kg $\sigma_T = \sqrt{17.2^2 \times 10 + 2.1^2 \times 5}$ $= 54.59$ $P(T > 980)$ $= P(Z > 2.583)$ $= 0.0049$ (tables) $= 0.0049$ (GC)	E	Allow for variation due to rounding. Need to show $E[T]$, σ_T and the final probability.	1(b)(i) and 1(b)(ii) correct for Excellence. Evidence for M
TWO (a)	Poisson: $\lambda = \frac{60}{50} = 1.2$ $P(X \leq 2) = 0.87948$ (GC) $= 0.8795$ (tables)	A	CAO	2(a) correct for Achievement
(b)	Poisson ($\lambda = 1.2$) $P(X \geq 1) = 0.6988$ (0.69881, GC) Binomial ($\pi = 0.6988$, $n = 5$) $P(X = 3) = \binom{5}{3} \times 0.6988^3 \times 0.3012^2$ $= 0.3096$ (= 0.30956, GC)	A M	 CAO	$P(X \geq 1)$ Achievement. 2(b) for Merit.

(c)	$P(X \geq 1) = 0.27$ $P(X = 0) = 0.73 = e^{-\lambda}$ $\Rightarrow \lambda_{(1 \text{ sq m})} = 0.3147$ $\Rightarrow \lambda = 0.3147 \times 100 = 31.47$ $\Rightarrow \text{Total value} = 31 \times 12 \times 5 = \1860 $(\lambda = 31.47 \Rightarrow \text{Total value} = \$1888.20)$	<p>M</p> <p>E</p>	<p>Need calculation of λ and total value.</p> <p>Accept variations in rounding of λ, but must be at least 2 sig. fig.</p>	<p>Calculation of λ for M</p> <p>2(b) and 2(c) for Excellence.</p>
THREE	<p>Binomial :</p> <ul style="list-style-type: none"> - Probability is constant at 0.7 for each trial for Tom and 0.6 for Tane. - There are only two outcomes, catch a wave or not. - There is a fixed number of trials: 5 waves. - We must assume that Tane catching a wave is independent of him catching the next wave he tries for, and similarly for Tom. <p>We must assume Tom catching a wave is independent of Tane catching a wave.</p> <p>Tom $n = 5$, $p = 0.7$, $P(X = 2) = 0.1323$</p> <p>Tane $n = 5$, $p = 0.6$, $P(X = 2) = 0.2304$</p> <p>P(each catch 2 waves) $= 0.2304 \times 0.1323$ $= 0.03048192$</p>	<p>E</p> <p>A</p> <p>A</p> <p>M</p>	<p>Conditions must be given in context.</p> <p>E</p> <p>CAO for Tom or Tane for A</p> <p>CAO for M</p>	<p>P($X = 2$) correct for either Tom or Tane for Achievement.</p> <p>OR</p> <p>P(each catch 2 waves) correct for Merit.</p> <p>OR</p> <p>All correct and at least 3 of the conditions in context for Excellence.</p>

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
Use probability distribution models to solve straightforward problems. 2 A	Use probability distribution models to solve problems. 2 M	Use and justify probability distribution models to solve complex problems. 2 E

The following Mathematics-specific marking conventions may also have been used when marking this paper:

- Errors are circled.
- Omissions are indicated by a caret (^).
- **NS** may have been used when there was not sufficient evidence to award a grade.
- **CON** may have been used to indicate 'consistency' where an answer is obtained using a prior, but incorrect answer and **NC** if the answer is not consistent with wrong working.
- **CAO** is used when the 'correct answer only' is given and the assessment schedule indicates that more evidence was required.
- **#** may have been used when a correct answer is obtained but then further (unnecessary) working results in an incorrect final answer being offered.
- **RAWW** indicates right answer, wrong working.
- **R** for 'rounding error' and **PR** for 'premature rounding' resulting in a significant round-off error in the answer (if the question required evidence for rounding).
- **U** for incorrect or omitted units (if the question required evidence for units).
- **MEI** may have been used to indicate where a minor error has been made and ignored.